REMARKS

The Office Action mailed November 3, 2004 has been received and its contents carefully noted. Applicant acknowledges, with appreciation, the indication of claims 8-9 and 14-17 as containing allowable subject matter. Reconsideration of this application is respectfully requested in view of the foregoing amendments and the comments set forth below.

By this Amendment, claims 1, 6 and 8 are amended; and claim 2 is canceled. The subject matter of claim 2 has been incorporated into claim 1. In addition, claim 8 has been rewritten into independent form including the limitations of original claims 1 and 6 and thus, claims 8 and 9 should be allowed over the prior art of record. Accordingly, claims 1 and 3-17 are pending in the present application.

Claims 1-3, 6, and 10-12 were rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent Application No. 2002/0041678 to Basburg-Ertem et al. (hereinafter referred to as "Basburg-Ertem") as explained in the paragraphs spanning pages 2-4 of the Action. Claim 4 was rejected under 35 U.S.C. §103(a) as being unpatentable over Basburg-Ertem in view of U.S. Patent Application No. 2002/0057790 to Duttweiler et al. (hereinafter referred to as "Duttweiler") and "Inside the Gates – CMOS Technology" by Braught (hereinafter referred to as "Braught") for the reasons set forth in paragraph 2 spanning pages 5-6 of the Action. Claim 5 was rejected under 35 U.S.C. §103(a) as being unpatentable over Basburg-Ertem in view of Duttweiler as set forth in paragraph 3 spanning pages 6-7 of the Action. Claims 7 and 13 were rejected under 35 U.S.C. §103(a) as being unpatentable over Basburg-Ertem in view of U.S. Patent No. 6,434,110 to Hemkumar for the reasons given in paragraph 4 spanning pages

7-8 of the Action. These rejections are traversed.

As explained in the Background of the Invention, known echo cancelers used in telecommunication systems remove far-end echo from the signal transmitted from the near end to the far end. Known algorithms, which update an adaptive filter of conventional echo cancellers, perform poorly when both parties (the near end and the far end) talk at once. Thus, conventional echo cancelers suspend the adaptation process in the double-talk state. However, known double-talk detectors either misinterpret changes in the echo path as double –talk (thereby causing adaptation to be suspended when it is needed) or correlate echo replica signals produced by the near-end input signal and incorporate the correlated result into the double-talk detection process. The correlation method employed is unreliable, however, in the presence of vocal background noise, such as office noise. These problems associated with the prior art are overcome by the claimed echo canceler and method of controlling the updating of tap coefficients in an adaptive filter as set forth in independent claims 1 and 10.

In particular, the present invention enables an adaptive filter in an echo canceler to continue to adapt to echo path change even when the echo path change is mistakenly detected as double-talk. An echo canceler according to the claimed invention uses an adaptive filter to generate an echo replica signal from a received far-end signal and uses the echo replica signal to cancel an echo component in a near-end signal, thereby generating a transmit signal where the adaptive filter adapts to changes in the echo path by updating tap coefficients and includes a double-talk detector for detecting at least a double-talk state, an echo path change detector for estimating an echo path loss on an echo path by which the echo component reaches the near-end signal from the received

far-end signal thereby detecting echo path change, and a control unit for controlling adaptation in the adaptive filter according to detection of the double-talk state by the double-talk detector and detection of echo path change by the echo path change detector by suspending or abating updating of tap coefficients when the double-talk detector detects the double-talk state, provided the echo path change detector does not detect echo path change; and by permitting the tap coefficients to be updated normally when the double-talk detector detects the double-talk state if the echo path change detector also detects echo path change.

The claimed method overcomes the shortcomings of the prior art by controlling the updating of tap coefficients in an adaptive filter in an echo canceler that uses an adaptive filter to generate an echo replica signal from a received far-end signal and uses the echo replica signal to cancel echo from a near-end signal, thereby generating a transmit signal. This method achieves the stated goal by detecting a double-talk state in which the received far-end signal and the near-end signal are both active, detecting echo path change from an echo path loss on an echo path from the received far-end signal to the near-end signal, suspending or abating the updating of the tap coefficients in the double-talk state when the echo path change is not detected, and allowing normal updating of the tap coefficients in the double-talk state when the echo path change is detected.

In contrast, Basburg-Ertem is directed to a method an apparatus for integrated echo cancellation and noise reduction for fixed subscriber terminals where double-talk detection is performed using either the voice activity detector of a codec or a secondary double-talk detector. In the Action, the Examiner characterizes the secondary double-talk

detector 70 of Basburg-Ertem as being "an echo path change detector for estimating an echo path loss on an echo path by which the echo component reaches the transmitted near-end signal form the received far-end signal thereby detecting echo path change" apparently because of its voice activity function. See page 2, last six lines of the Action. However, equation (6) in paragraph 52 shows that the secondary double-talk detector of Basburg-Artem detects whether the near-end signal level (near-end speech s(n) plus echo y(n)) equals or exceeds the product of the ERL and the maximum far-end signal level contributing to the echo, decides that near-end speech is present when this condition is true, and disables adaptation when near-end speech is present. Neither the content of equation (6) nor the description provided by Basburg-Artem et al. suggests the detection of a change in the echo path. Instead, equation (6) clearly distinguishes between the presence and absence of near-end speech, even in the absence of any change in the echo path and therefore appears to be useless for detecting changes in the echo path.

Basburg-Artem also states at the end of paragraph 51 that the secondary double-talk detector 70 and the voice activity detector 32 (VAD) that the Action characterizes as the double-talk detector of the present invention are used at different times and are not used simultaneously. This teaching contradicts amended claim 1, which implies the simultaneous use of the double-talk detector and the echo path change detector, because the control unit needs the results from both detectors to decide whether to enable or disable adaptation. For the same reason, Basburg-Artem also contradicts claim 10 as "suspending or abating the updating of the tap coefficients" requires that the double-talk state be detected and that an echo path change is not detected.

In rejecting claim 2, it is the Action's position that adaptive filter of Basburg-

Artem "inherently updates as the echo path changes, and during the initial non-convergent phases." See page 3, lines 6-8 of the Action. Thus, the Action tacitly acknowledges that Basburg-Artem does not recite or disclose the claimed echo path detection and the claimed function of the control unit. It appears to be the Action's position that the filter coefficients are not updated when the secondary double-talk detector does detect change and are updated when secondary double-talk detector does not detect change. See page 3, lines 11-14 of the Action. This "inherency rejection" is the direct opposite of the recited claim language set forth in amended claim 1 and claim 10. In particular, claims 1 and 10 of the present application recite that the updating of the coefficients is suspended or abated **(not updated)** when a double-talk state is detected and the echo path change detector **does not detect change**, and permits the tap coefficients **to be** updated if the echo path change detector **does** detect change.

In summary, Basburg-Artem fails to disclose the recited echo change detector and control unit of amended claim 1 and fails to disclose the "suspending or abating the updating of the tap coefficients in the double-talk state when said echo path change is not detected" and "allowing normal updating of the tap coefficients in the double-talk state when said echo path change is detected" as recited in independent claim 10. Accordingly, Basburg-Artem cannot anticipate claims 1, 10 and their respective dependent claims 3, 6, and 11-12. Withdrawal of the anticipation rejection is respectfully requested.

With respect to claim 6, which has been amended to avoid possible confusion with the terms "transmitted near-end signal" and "transmit signal", this claim includes a further feature concerning the separation between the echo path loss and its long-term average. The Action points out that the quantity ERL_{est} in equations (6) and (7) in

Basburg-Artem can be regarded as a long-term average of the echo path loss. This may be true, but Basburg-Artem is silent about the recited separation between the echo path loss and its long term average (claim 6, lines 12-13). For example, there is no teaching of a comparison between ERL_{est} and the ratio $p_{avg}(n)/x_{avg}(n)$ of which ERL_{est} is the long-term average. Instead, equation (6) compares the long-term average of the echo path loss with the near-end signal level. Consequently, Basburg-Artem fails to disclose this feature.

The Applicant would like to point out that the idea behind amended claim 6 is that the true double-talk state can be distinguished from an echo path change because true double-talk alters the echo path loss (the ratio between the received far-end signal level and the near-end signal level), echo path change (in the hybrid, for example) tends to leave the echo path loss unaltered. This is described in the present specification from line 22 on page 10 to line 26 on page 11. No teaching of this idea is found in Basburg-Artem. As noted by the Applicant, Basburg-Artem teaches the use of different methods of detecting double-talk before and after the filter coefficients converge and is not concerned with echo path change, whereas the claimed invention teaches a method of distinguishing double-talk from echo path change and uses this method regardless of whether or not the filter coefficients have converged. Consequently, it is submitted that that Basburg-Artem addresses different problems, as well as operates in different ways to have different effects, and cannot render the claimed invention unpatentable.

The secondary references to Duttweiller, Braught, and Hemkumar were applied for specific teachings and do not disclose, teach or suggest the recited echo change detector and control unit of amended claim 1 or the "suspending or abating the updating of the tap coefficients in the double-talk state when said echo path change is not

detected" and "allowing normal updating of the tap coefficients in the double-talk state when said echo path change is detected" as recited in independent claim 10. Further, it is submitted that there is no motivation to modify Basburg-Artem to function as recited in amended claim 1 and independent 10. Accordingly, it is believed that claims 4-5, 7 and 13 are not rendered obvious by any combination of the prior art of record.

In view of the above, it is respectfully submitted that Claims 8 and 9 should be allowed and that claims 1, 3-7 and 10-13 are not anticipated by Basburg-Artem, nor are the claims rendered obvious by any combination of Basburg-Artem with the prior art of record. Applicant therefore respectfully requests that the Examiner reconsider the previous rejections, withdrawn the same and issue a Notice of Allowance indicating that claims 1 and 3-17 are allowed over the prior art of record.

Applicant believes that a full and complete reply has been made to the outstanding Office Action and, as such, the present application is in condition for allowance. Should the Examiner believe that additional issues remain, and that a conference with Applicant's representative would be helpful, he is invited to telephone the undersigned at the number listed below.

Respectfully submitted,

Date: March 3, 2005

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